

## Problems in the Measurement of Major Change in Specialized Organizations

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The environment for the military in general is becoming more complex and faster moving. There is a need for more military organizations which themselves are more complex, faster acting and reacting, which design themselves for a mission and environment which is unique today and then redesign themselves for a changing situation in the future. These organizations generally utilize high-technology and their membership is educated. What methods can these units use to sense and adapt rapidly and properly to a changing environment? Which combinations of technology, work structures, organization designs and procedures are appropriate in which environment? In studying this problem, how can the field researcher systematically study both the development of techniques and procedures to help these organizations self-adapt and also study the impact these new techniques have on organizational performance?

To put it differently, what measurement methods are appropriate in a formative and summative evaluation study in which the sample size is one, environmental variables affecting the sample are changing, there are no comparable sample organizations, and the treatment itself is designed to impact on all aspects of the sample and its relationships with its environment?

If the organization is more effective, whatever that is, after the treatment, should the treatment be considered as possibly having had an effect? More importantly, how does one know if one properly and competently administered the treatment?

Illustration of the Problem

To illustrate the problem and provide us with material for discussion, I shall relate a recent Army Research Institute project in sociotechnical systems analysis as applied to the World-wide Military Command and Control System, Data Processing Center - Europe (WWMCCS, DPC-E).

The military has, like the rest of western society, an increasing number of specialized, high-technology organizations which must adapt to changing technology, staffing, and mission environments. Examples are the data processing centers, signal units, and the air defense units in West Germany. In 1978, sociotechnical systems analysis methods seemed appropriate as a way of helping these units assess and redesign themselves, but practical research remained. A contract was let to Dr. Bill Pasmore at Case Western Reserve University's School of Management. Pasmore was to develop and try

<sup>1</sup>The views expressed in this paper are those of the author and do not necessarily reflect the view of the US Army Research Institute or the Department of the Army,

out a model of sociotechnical systems analysis adapted to the military. The target unit would be the WWMCCS, DPC-E. I was the Contracting Officer's Technical Representative and was on site the first year of the project as a consultant. Note that the purpose was to develop and try out a model adapted to the military, not demonstrate the effectiveness of an already developed model.

Sociotechnical systems theorists argue that the human and technological subsystems of organizations operate according to different sets of laws, and that making one as efficient as possible may have unfavorable effects on the operation of the other; therefore, for the organization to operate smoothly overall, it is necessary to design each system with respect to the other. To accomplish this joint optimization, the Commander, with the help of recommendations from an expert consultant and unit members, over time, reassesses and modifies where necessary the unit's organization structure and policies, technologies, task structures, and work methods.

The WWMCCS, DPC-E is located in Heidelberg, West Germany in the Headquarters of the US Army - Europe. It serves as a communication link for the Joint Chiefs of Staff and as a command and control information systems developer for the headquarters. The director of the facility saw the following challenges in the years ahead: (1) decreasing number and skill level of personnel; (2) need for a mobile capability in addition to the present fixed station posture; (3) increases in total demand for services and a changing type of demand from users.

The overall project strategy could be summarized as a recurring cycle of analysis, recommendations, and implementation. Organization members at all levels would be heavily involved, with the consultant passing on necessary skills to members so they could continue the process after the consultant was gone.

#### First Data Collection

At the beginning and end of the 20-month time frame during which the consultants periodically visited the unit and carried out the intervention, an intensive data gathering operation was conducted using a survey questionnaire, interviews, observation, and archival data. The survey instrument, very broad ranging yet in-depth, measured organizational climate, work and job characteristics, satisfaction, formalization of procedures, distribution of power, and demographics. The initial data suggested the unit was in fairly good shape. Employees were satisfied with the design of their jobs, supervision, co-workers, rewards. They were motivated by their work, were learning useful skills, and liked their location.

Seventy-eight percent of the unit members were interviewed. Questions were developed by both the consultants and two "core groups." The core groups were parallel organizations within the unit formed to provide an additional sensing/feedback mechanism to the command group. They were composed of 8 to 12 members, recruited from all levels and parts of the unit. Interview data showed individuals working in different parts of the unit held widely divergent views about it. While the interviews again demonstrated a general

satisfaction with the organization, they did also show, in various sections of the unit, that there was dissatisfaction with the work itself, training, fairness, measurement of productivity, cooperation across boundaries, relations with users, and instability of personnel.

The third major assessment was of the technical systems. Adapting methods used primarily by industrial engineers, the consultants assessed role descriptions, skills needed, team and individual goals, task activities, information used, problems encountered, and recommendations for changes in task procedures. A variance matrix was developed which showed impact of problems in one part of the organization on other parts. From this analysis, needed changes in organization design, policies, and procedures could be identified.

Thus, while there was a clear need in the director's mind to prepare for changes in the future, the present state of the unit was reasonably satisfactory. It was operating effectively and to the general satisfaction of most of its members. The need for change was not readily apparent nor was change desired by many personnel. The critical issues were to prepare it for the future and to help it improve its productivity without lessening its quality of work life. The unit would be ideal for the development of a model for sociotechnical systems analysis, but far less desirable as a site to demonstrate the power of the model.

#### Changes Made

Several major and many minor changes were made in the unit. Each change was thoroughly thought out and talked over by the core group, by management and the consultants. Decisions were made to move from a fairly standard organization design to a matrix design; this in turn would allow the formation of small temporary project teams and more formal emphasis on skill training. Performance contracts for both project and skill development were to be agreed upon, and rewards would be tied to performance. The core group was to be continued.

Interview data were gathered by the core group members and the consultants throughout the time period of the change, with a formal interviewing of about half the unit one year after the start of the project. It was obvious that the change process here was a slow and difficult one, and the unit was still learning and deciding about itself.

#### Later Data Collections

About five months later, the WWMCCS DPC-E took part in a major exercise. This is viewed as the real test of the system's capability. Compared to years past, user demand exploded. New technology put the unit's services in much greater demand for programming, training users, and installing telecommunications equipment. At the same time, there was a slight decrease in unit personnel strength and skill level. The unit trained and serviced significantly more users and increased programmer support of exercise activities by 15 percent while maintaining existing duties.

Four months later, a second survey was readministered to the unit. Note there was about 80 percent turnover in respondents between the first and second survey. There were no significant changes in organization climate, satisfaction, or other attitudes. The unit will be looked at again in the Spring of 1982 in much the same way.

My colleague, Ul James, and an associate, looked at the unit intensively for about 2½ days in August 1981. Using structured interview methodology, they found little awareness of change or improvement among unit members. Unit members attributed the hard outcomes of improved exercise performance not to the sociotechnical systems operation but to the good management and hard effort of the unit. There was some question as to whether the change to the matrix was either very smooth or didn't occur.

Thus we have a difference of opinion on what occurred and why it occurred. Different methods of data gathering at different points in time revealed different aspects of the organization. To what extent are these different viewpoints correct? How does one measure an organization as this one is?

#### Restatement of the Problem

To sum up, <sup>↘</sup>field research in organizations is costly in time, money, and the potential for error. Often, it is desirable to get a formative and summative evaluation of a new treatment at the same time. Yet in this problem the unit is chosen because it is changing in its technology, personnel, and environment, and is unique. What generalizations can be made from such a study? The problem area seems a proper field of inquiry, yet there are no accepted or proper methods of inquiry. What measurement methods are appropriate to (1) determine how well the treatment is being administered and (2) determine impact of the treatment, when the sample organization is chosen because it is unique, constantly changing, and important.

#### Major Reference

Pasmore, W.; Shani, R.; and Kaplan, M. Sociotechnical Approaches to Organization Change in USAREUR. US Army Research Institute for the Behavioral and Social Sciences, Draft Final Report, 1981.

Alternative Approaches to the Design and Analysis of Objectives-  
Referenced Competency Tests

O'Neil, Harold F., US Army Research Institute for the Behavioral and Social Sciences, Alexandria, Virginia (Chair); Baker, Eva L., Choppin, Bruce, & Quellmalz, Edys S., UCLA Graduate School of Education, Los Angeles, California. (Thurs. P.M.)

The need to describe trainee competency in relation to specific tasks and skill levels requires approaches to the construction and analysis of criterion test situations quite different from current methodologies. In "Matching Tests with Instruction," Eva L. Baker will describe the design of a system for matching explicit content requirements of instructional and testing tasks, estimating their "fit" and assessing the cost of the process. Edys S. Quellmalz will draw upon cognitive learning research to describe a continuum along which features of test-like tasks can approximate the information bases and cognitive operations trainees must activate in actual situations. Alternative validation procedures will also be described. Bruce Choppin describes how latent trait modeling of test responses can be used to define a scale of performance in terms of specific tasks and to locate an individual examinee within a region of the scale.